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FLOOD INSURANCE STUDY

TOWN OF WYOMING, DELAWARE
KENT COUNTY

SEPTEMBER 16, 1980

federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 100020

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

FLOOD INSURANCE STUDY
TOWN OF WYOMING, DELAWARE

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Wyoming, Kent County, Delaware, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Wyoming to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3. In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by Edward H. Richardson Associates, Inc., for the Federal Insurance Administration, under Contract No. H-4597. This work was completed in April 1979.

1.3 Coordination

Community base map selection and the identification of flooding sources requiring detailed and approximate study were accomplished in preliminary Consultation and Coordination Officer's (CCO) meetings in June and July 1977. These meetings were attended by representatives of Edward H. Richardson Associates, Inc. (the study contractor), the FIA, and the Town of Wyoming. Hydrologic and hydraulic analyses for the Isaac Branch were coordinated with those prepared by Greenhorne and O'Mara, Inc., in conjunction with their 1975 study for the unincorporated areas of Kent County.

At the outset and during the course of this study, several agencies were notified and solicited for information concerning flooding in the study area. The U. S. Geological Survey (USGS) supplied maps of flood-prone areas and the Delaware State Planning Office supplied FIA Flood Hazard Boundary Maps. Many other agencies expressed interest in the study but were unable to provide additional information. These agencies included the Soil Conservation Service (SCS), the U. S. Army Corps of Engineers (COE), the Delaware Department of Natural Resources and Environmental Control, the Kent County Planning Department, the Town of Wyoming, and the University of Delaware Water Resources Center.

A final CCO meeting was held on May 8, 1980, in order to present the results of this study to the community. Representatives of the study contractor, the FIA, and the Town of Wyoming attended this meeting.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Wyoming, Kent County, Delaware. The area of study is shown on the Vicinity Map (Figure 1).

Flooding on the Isaac Branch and Wyoming Lake within the study area was studied by detailed methods. Flooding on an unnamed tributary to Wyoming Lake was studied by approximate methods.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through April 1984.

Approximate methods of analysis were used to study those areas having low development potential and minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by the FIA.

2.2 Community Description

The Town of Wyoming is centrally located in Kent County, in central Delaware. Wyoming is bordered by the Town of Camden to the east, the City of Dover to the north, and by unincorporated areas of Kent County to the south and west.

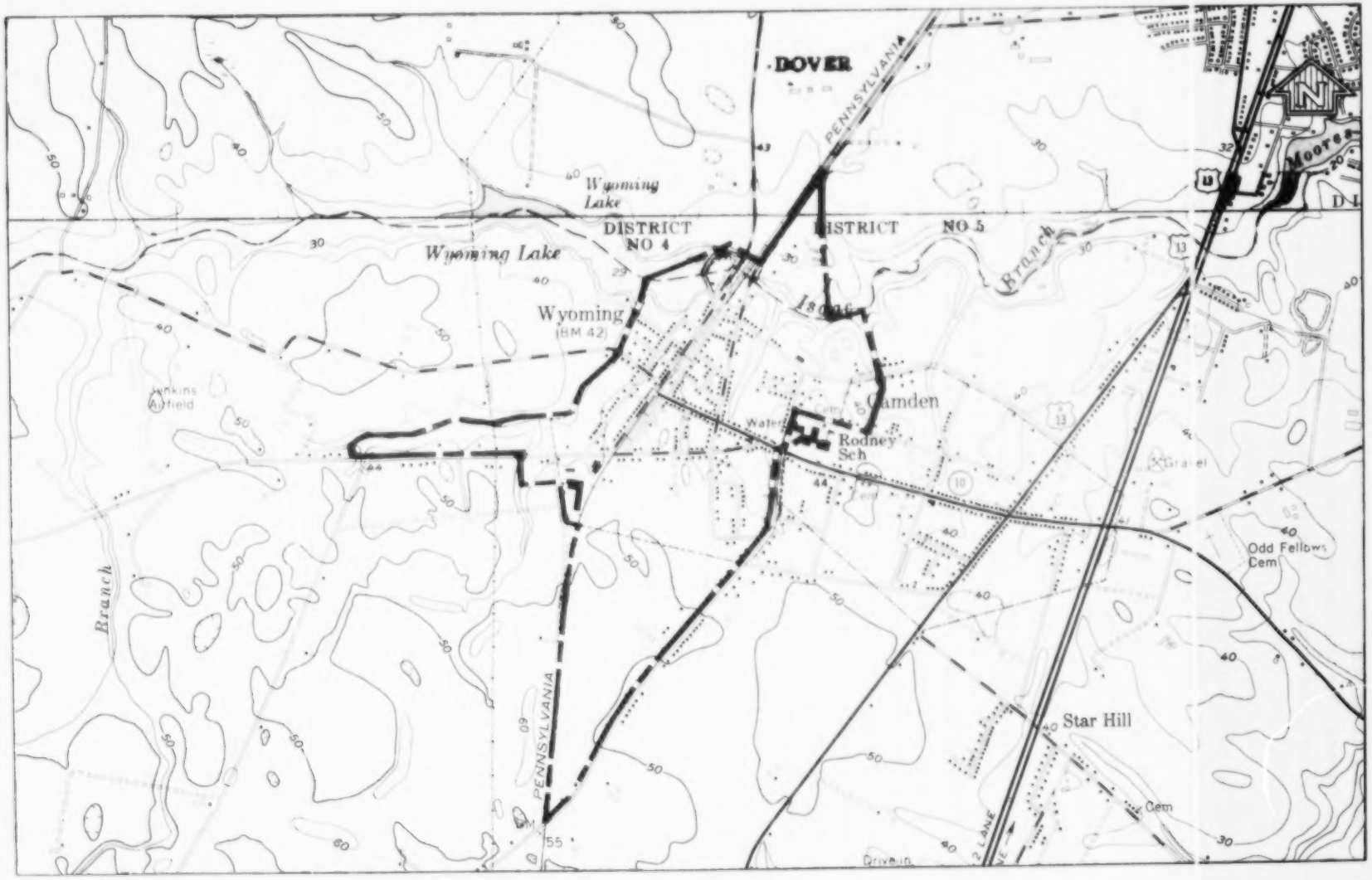


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Insurance Administration

TOWN OF WYOMING, DE

(KENT CO.)

VICINITY MAP

The major stream in the Town of Wyoming is the Isaac Branch, which is located in the northern section of town. A portion of the western corporate limits is formed by an unnamed tributary to Wyoming Lake.

The 1975 population of Wyoming was 1,059; this represented no change from the 1970 population.

The economy of the Town of Wyoming is diverse, with 79 percent of the employment coming from manufacturing, wholesale and retail trade, services, and government. Commercial and residential development is located along the Isaac Branch.

2.3 Principal Flood Problems

Flooding in the Town of Wyoming is caused primarily by precipitation runoff, especially in the spring. Businesses and residences situated along the Isaac Branch are subject to occasional flooding. Another potential source of flood damage exists in the community's proximity to the Atlantic Ocean, which lies ten miles to the east. The Atlantic coast is subject to occasional hurricane activity, although they infrequently come ashore.

Severe flooding has occurred in Kent County several times. The most serious floods occurred in August 1967, and in August and September 1971. Of these, the August 5, 1967 flood was the most severe, with flooding damage in Delaware estimated to be $200,000. However, effects from these floods in the Town of Wyoming were minor.

2.4 Flood Protection Measures

There are no flood protection measures or structures in the Town of Wyoming.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long-term average period between

floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one-percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten) and, for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency and peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

The hydrologic analyses used in this study were prepared earlier by Greenhorne and O'Mara, Inc., as a part of their Flood Insurance Study for the unincorporated areas of Kent County (Reference 1). These analyses were reviewed and incorporated into this study. The calculations made in the analyses are based upon synthetic unit hydrograph techniques established by the SCS and explained in their National Engineering Handbook (Reference 2). This method is especially appropriate for uniform agricultural watersheds, such as that of the St. Jones River, of which the Isaac Branch is a tributary. A stream gage is maintained by the USGS on the St. Jones River, but it was not considered practical to use a log-Pearson Type III analysis as the primary hydrologic method. This was because of the short duration of recorded data from the gage, which was established in 1958.

A summary of drainage area-peak discharge relationships for the stream studied in detail is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
ISAAC BRANCH					
At State Route 13	13.24	615	1,220	1,540	2,190

Water-surface elevations for Wyoming Lake were also adopted from the Flood Insurance Study for the unincorporated areas of Kent County (Reference 1). These elevations are shown in Table 2, "Summary of Elevations."

TABLE 2 - SUMMARY OF ELEVATIONS

FLOODING SOURCE AND LOCATION	PEAK ELEVATIONS (feet) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
WYOMING LAKE				
Shoreline within community	29.5	30.1	30.3	30.6

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Water-surface profiles for the Isaac Branch were developed using the COE HEC-2 computer step-backwater model (Reference 3). Starting water-surface elevations were adopted from the Flood Insurance Study for the unincorporated areas of Kent County, Delaware (Reference 1).

Cross-section data for the stream studied by detailed methods were obtained by field measurement. All bridges and culverts were surveyed to obtain elevation data and structural geometry.

Roughness coefficients (Manning's "n") for the Isaac Branch were estimated following field inspection at each cross section. The roughness value for the main channel of the Isaac Branch is 0.04. The roughness values of the overbank areas range from 0.05 to 0.08.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks used in the study are shown on the maps.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if hydraulic structures remain unobstructed and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 10 feet (Reference 4). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year boundary has been shown.

Flood boundaries of the areas studied by approximate methods were delineated using the Flood Hazard Boundary Map for the Town of Wyoming (Reference 5).

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent

flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

A floodway was delineated along the shoreline of Wyoming Lake in order to avoid any encroachment into the lake.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plains. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 3).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source affecting the Town of Wyoming.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Isaac Branch								
A	17,780	234	1,042	1.5	21.5	21.5	22.5	1.0
B	18,630	28	157	9.8	23.1	23.1	23.9	0.8
C	18,714	23	200	7.7	25.0	25.0	25.3	0.3
D	18,801	22	188	8.2	26.1	26.1	26.3	0.2
E	18,930	94	814	1.9	27.2	27.2	28.2	1.0
F	18,980	94	800	1.9	27.7	27.7	28.3	0.6

[1]Feet above confluence with St. Jones River

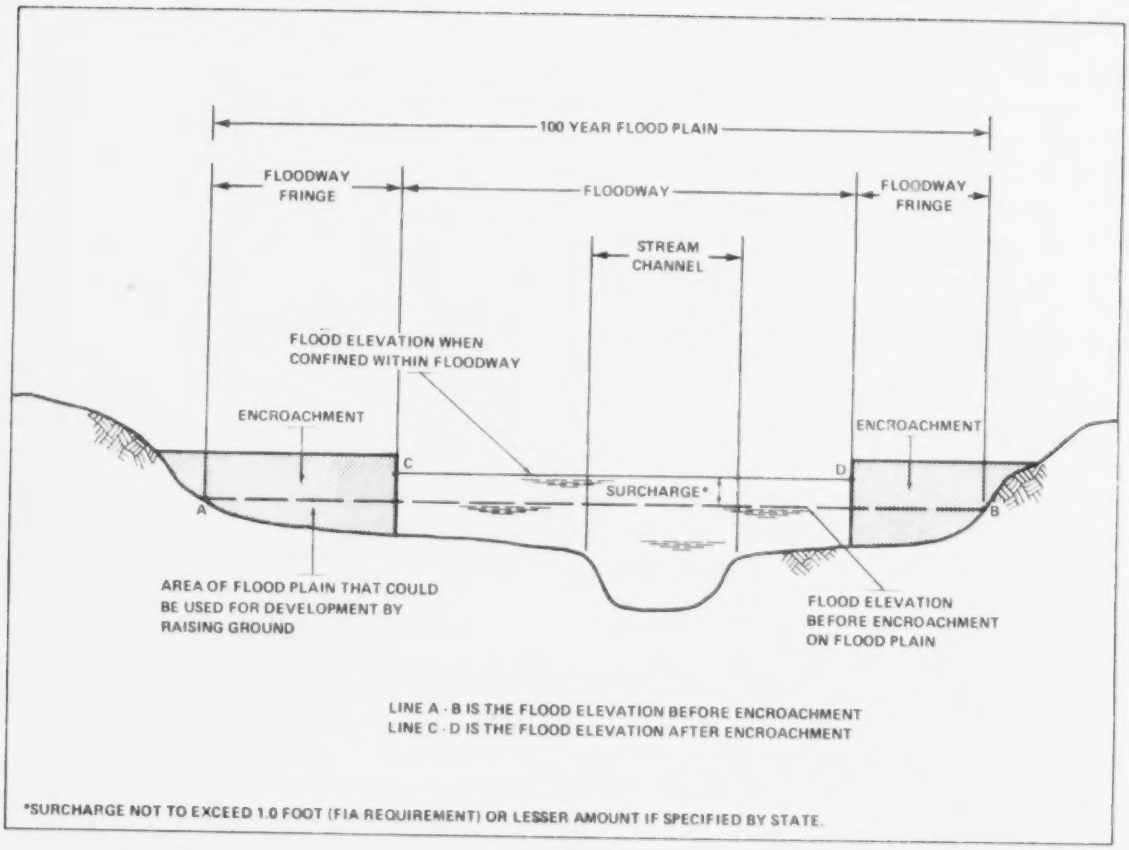
TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF WYOMING, DE
(KENT CO.)

FLOODWAY DATA

ISAAC BRANCH


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the Town of Wyoming are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 4).

5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Isaac Branch Reach 1	01	-1.7	-0.5	+1.0	015	A3	Varies
Wyoming Lake Reach 1	01	-0.8	-0.2	+0.3	010	A2	30

[1]Flood Insurance Rate Map Panel
[2]Weighted average
[3]Rounded to the nearest foot - see map

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF WYOMING, DE
(KENT CO.)

FLOOD INSURANCE ZONE DATA

ISAAC BRANCH AND WYOMING LAKE

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Town of Wyoming was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A2, A3:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also, areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 4, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the Town of Wyoming.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Wyoming is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

There are no other Flood Insurance Studies for the Town of Wyoming; however, the results of this study have been coordinated with those of a Flood Insurance Study for the unincorporated areas of Kent County, Delaware (Reference 1). There are also Flood Insurance Studies in progress for the adjacent Town of Camden (Reference 6) and the City of Dover (Reference 7). These studies will be in exact agreement with the Town of Wyoming study.

This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Insurance and Mitigation Division of the Federal Emergency Management Agency, Regional Director, Region III Office, Curtis Building, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106.

8.0 BIBLIOGRAPHY AND REFERENCES

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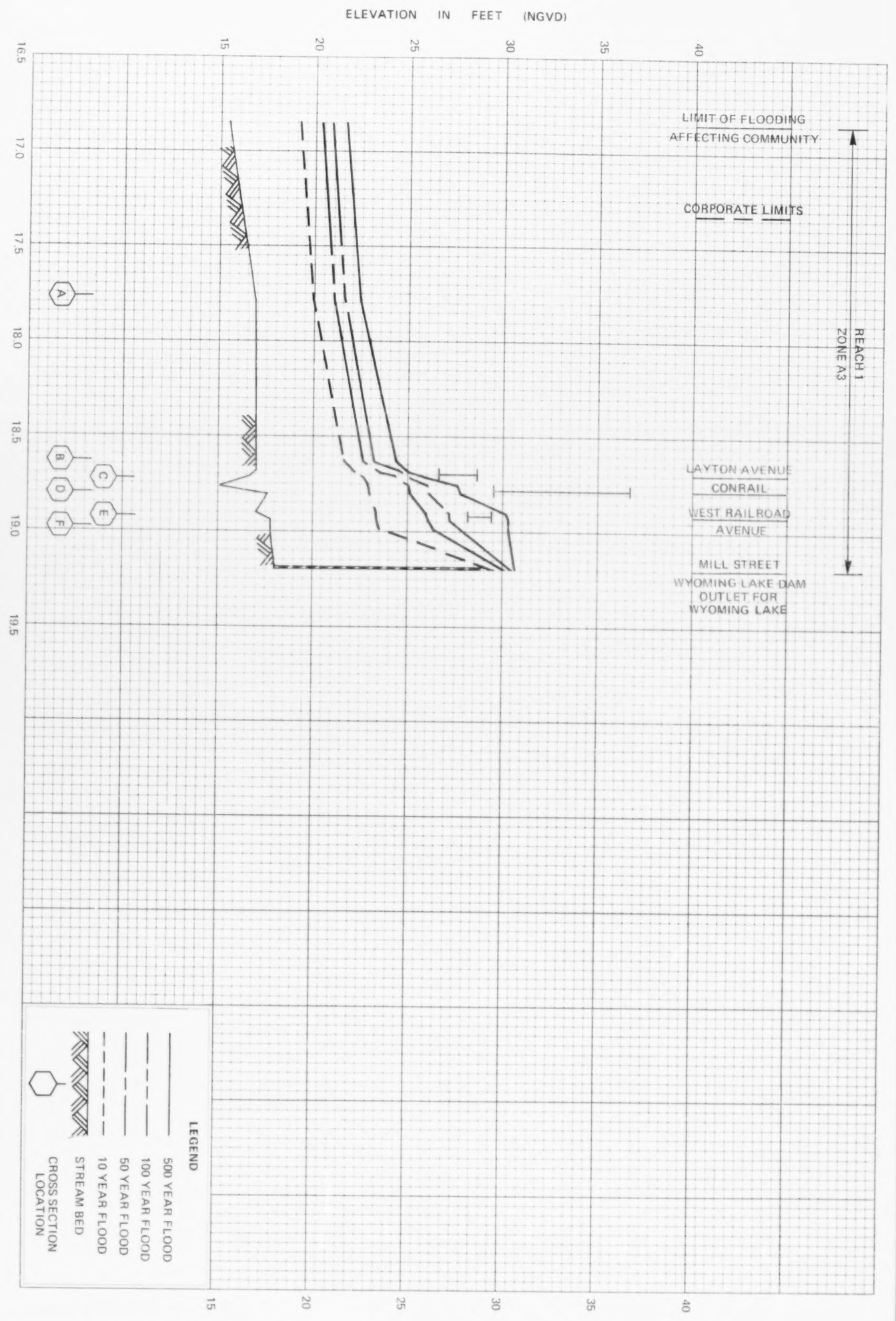

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF WYOMING, DE
(KENT CO.)

FLOOD PROFILES

ISAAC BRANCH

01P